

ART. XVI.—*Facts from the Arcana of Nature apparently at variance with the accepted Theories of Science.*
By Mr. J. WOOD BELLBY.

[Read by the President, 14th September, 1868.]

Astronomy regards the figure of the Earth as that of a sphere, somewhat flattened towards the poles, and bulged out equatorially. This definition of its form is deduced from the assumption that its primitive state was that of a molten mass of matter, rotating in space, with such velocity as necessarily to cause it to assume an oblate spheroidal form. Upon this fundamental hypothesis are based therefore all astronomical calculations, defining the position, upon the exterior of the globe, of the points of the polar axis, the division of the globe into hemispheres by the terrestrial equator, and the position of the parallels of latitude and longitude. In the practical use of such calculations applied to geodetic measurements, and defining positions at sea, of vast importance to the safety of our shipping, results, questionable to the accuracy of scientific formulas prescribed for the conduct of these calculations, as applied to local observations, are constantly occurring, and too often with disastrous consequences to human life and property. An analysis of the question cannot therefore be deemed unimportant, more especially if carried out without bias in favour of theories adopted by early philosophers, whose means of comparing observations of the phenomena of Nature were but few compared with ours.

The late Astronomer Royal, Dr. Maskelyne, remarked that "Probably no branch of science is more subject to erroneous conclusions than that of hydrology." The questionable accuracy of existing modes of conducting astronomical observations to determine the Figure of the Earth, may be deduced from the facts undernoted.

1. Arago observes, "That the several degrees measured on each meridian, between the pole and the equator, combined two and two, do not all give the same value for the flattening at the poles." It is also observed, that the alteration in the length of the degrees is very irregular, and as yet unaccountably so.

2. The refraction of light by the atmosphere is very great when the visual angle is nearly horizontal, and hence arises great errors in the measurement of angles, whether the

observed objects are in the same level or not. These errors are usually remedied by an empirical law for terrestrial refraction; but all such laws fail to apply in the varied states of rarefaction or of moisture, in which the lower strata of the atmosphere are found.

3. An error of a single second in the celestial arc corresponds to about one hundred feet on the surface of the Earth; and a long series of astronomical observations must be made to obtain the latitude of any place true to a second.

4. Local attraction of mountains, and variations in the density of strata in the Earth are said to affect the accuracy of the pendulum.

5. It has been demonstrated that the figures of the northern and southern hemispheres are dissimilar.

6. No measurements have yet been attempted within such distance of the poles as to preclude the possibility of an extended polar radius, in excess of the supposed equatorial radius.

7. Some of the earlier observations made by the French astronomers; gave results directly contrary to Newton's theory.

8. Unaccountable discrepancies have been noted in results of previous admeasurements of degrees on reversing the course of the ship from which the observations have been taken.

9. Analysis of the theory of rate of transmission of light may affect the time of high noon recorded, to a degree imperfectly provided for by previous empirical conclusions.

Noting how rare it is—if not in practice impossible—in land surveys by successive operators, though using approved instruments, to maintain lengthened parallels, the accuracy of sea measurements must ever be doubtful. Moreover, Sir John Herschel admits that “a more exact knowledge of the physical structure and figure of the Earth, and of the niceties of astronomy, may render a different mode of computing latitudes necessary.” Thus, this eminently scientific astronomer does not bar entrance on the path of knowledge by asserting perfection of existing theories, or the infallibility of the conclusions of our early and justly renowned philosophers.

Our task shall be to demonstrate that there exists, to say the least, a difference of opinion amongst astronomers, mathematicians, geologists, and philosophic reasoners, as to the accuracy of our early philosophic theories respecting the figure and structure of the Earth, and its im-

perative continuance upon a permanent axis of rotation. We shall, however, disclose an agency in continuous operation in Nature, productive of elongation of the polar radii, but so unequally developed, though strictly in accordance with natural laws, as presently to increase the arctic elongation disproportionately, so as continuously to shift the centre of gravity of the Earth's volume, and thus alter its axis of rotation, and consequently the position of the polar extremities upon the sphere, and cause an apparent change of its position upon the plane of its orbit.

The defined position of the magnetic poles presents an anomaly with reference to the stated figure of the Earth, they being "not diametrically opposite, nor is the variance so slight as it necessarily would be if the figure of the globe were spherical, or equally depressed at the poles. While the north magnetic pole is defined by observation of Admiral Ross in lat. $70^{\circ} 5' 17''$ N., long. $96^{\circ} 46' 45''$ W., the south is stated as in lat. 70° S., long. 154° E. They are thus neither diametrically opposite to each other, nor either of them coincident with the geometrical pole of the magnetic equator." Again, the division of the globe into two hemispheres by a supposed central line, termed the terrestrial equator, and the geographical definitions of latitude, have been computed—subject to the Newtonian theory of the oblate polar extremities affecting the necessary observations in an admitted degree, as also disturbing agencies, arising from solar, lunar, or planetary attraction upon the alleged bulge or redundance of matter (said to amount to thirteen miles in thickness at the equator)—in excess of oceanic or other dilatation on other parts of the earth's contour. Pendulum experiments are even stated as agreeing in giving a greater ellipticity to the earth than that which is deduced from the comparison of arcs of meridian, amounting to 1-306th. Upon the principle of necessity of maintaining current hypotheses upon the relative densities of the various proportions of fluid and solid matter, composing the superficial rind of the sphere, and the notion of a flattening at the poles, this aberration has been ascribed to inequalities in the motion of the moon.

It has been announced as a recent astronomical discovery, that the distance from the sun to the earth, formerly stated at 95,000,000 of miles, is actually less that quantity by 3,000,000. In other words, calculations involving the sun's meridian altitude, allowing for transmission of his light to our globe at the rate of 192,000 miles per second,

have heretofore over-estimated this element of dubiety by about sixteen seconds.

It is stated, that "In middle latitudes of the northern hemisphere, when the sun is eastward of the meridian during the forenoon, the needle points more eastward than on the average of the twenty-four hours; also, when west, during the afternoon, it points more to the westward." "The angle of the dip, like that of the variation, changes its value even at the same place, following of course the motion of the magnetic poles, which from observations made by Scoresby, Parry, Ross, and others in high latitudes, appear to have a motion westwards, the annual amount of which is 11' 4". It has, however, been conjectured that there are two distinct poles of magnetic attraction in arctic regions, one defined as the American, the other the Asiatic, presently many hundred miles apart, but apparently approximating towards perhaps ultimate coincidence. "The diminution of the magnetic dip noted in London for the last half century, is progressing with great regularity at a definite small annual rate." All such phenomena indicate the ceaseless operation of natural laws as yet unrecognised or imperfectly understood by science, but which may mark physical changes of vast and startling import to mankind.

Mr. Airy, the Astronomer-Royal, in his Report to the Board of Visitors for 1861, observes, "The Transit Circle and Collimators still present those appearances of agreement between themselves, and of change with respect to the stars, which seem explicable only on one of two suppositions, that the ground itself shifts with respect to the general Earth, or that the *axis of rotation changes its position*." Again, in 1863, he remarks, that "Some great cosmical change seems to have come upon the Earth, particularly affecting terrestrial magnetism."

The greatest vertical depth to which experiment by boring has tested internal heat is as yet stated to be but 2,100 feet, or about one ten thousandth part of the earth's radius, a limit far too fractional to admit of positive conclusions being formed thereon, as to the increasing internal heat of our globe towards its centre. Admitting, however, that progressive elevation of temperature is detected in certain localities, to that depth, the results of numerous experiments, undertaken to test the temperature of the ocean in various parts of the world, at vastly greater depths, are conclusively adverse to the doctrine of the internal heat increasing in proportion to

the depth attained from the surface. It is now an ascertained fact, that the deep sea is of one invariable temperature, and that a very low one. The calculations of Lenz, based upon Kotzebue's and Beechy's observations, give 36° , and those of Ross $39^{\circ}5$ Fahr. The depth at which this temperature is attained is 7,200 feet at the equator, diminishing to $56^{\circ} 26'$ S. lat., where it attains the surface, and the sea is of equal temperature at all depths. How can we reconcile such facts with the theory of central incandescence of the matter of our globe, or explain them so as to leave a fraction of evidence, in favour of a supposition of the primitive molten fluidity, and present central combustion of the earth? Yet upon such a gratuitous supposition is the alleged figure of an oblate spheroid deduced, as necessarily that of our globe, formerly described as flattened at the poles like an orange, but now regarded by astronomy as so slightly varying from perfect sphericity, as to require in an ordinary model, the nicest calculations or geometrical observation to define the existing difference. The Earth's velocity of rotation upon its axis, aided by the natural law of gravitation of its watery envelope to the centre of gravity, are adequate to account for an almost perfect sphericity of its external aspect, but we have no proof available either of its internal structure and the relative density of its proportions throughout, or of the form of its solid exterior, if divested of its oceanic covering. It may be as "without form," as the unshapely meteorites in our museums, and partially or wholly "void" of solid matter internally. How is oxygen supplied to maintain combustion in its central furnace? And how came water to remain over the vent-holes in the crust of its molten mass?

Astronomy declares that "the change, which, owing to precession and nutation, is constantly taking place in the position of the terrestrial axis of rotation, is only in respect of fixed points in space; for it can be shown that since the earliest recorded astronomical observations, the position of the poles of rotation on the Earth's surface has undergone no alteration whatever." Yet it appears that "in consequence of the precession of the equinoxes, the sun's place among the zodiacal constellations, at any given season of the year, is now greatly different from what it was in remote ages. Sometime before the age of Hipparchus, the first points of Aries and Libra corresponded to the vernal equinoxes, and those of Cancer and Capricorn to the summer and winter solstices. These points have now receded 30° from the constellations to

which they then corresponded. The vernal equinox now happens when the sun is in Pisces ; the summer solstice when he is in Gemini ; the autumnal equinox when he is in Virgo ; and the winter solstice when he is in Sagittarius. Astronomers, however, still employ the term, the first point of Aries, to denote the position of the vernal equinox."

This change in the apparent position of stars is astronomically termed, the uniform increase of longitude, by Sir John Herschel, "That is, the apparent approach of some stars and constellations to the pole or vanishing point of the Earth's axis, and recession of others." Thus, by the fiction of regarding the sun and stars as movable, with reference to stated points on our sphere, instead of such motion being confined to the Earth itself, and thus made apparent to man—as passengers in a coach see distant objects apparently passing their limits of observation—have astronomers been led to overlook the palpable proofs available of the continuous deviation terrestrially, of the poles of the Earth's axis of rotation, and consequently, to build up a series of fallacious theories to account for movements, referred to a revolution of the celestial sphere, which are simply terrestrial, apparently ever progressing since the beginning of our globe's history, and the inevitable and natural result of the operation of natural laws.

M. Adhémar (a French mathematician of eminence), author of *Révolutions de la Mer, Déluges périodiques, Paris, 1843*, accounts for the position assumed by the Earth upon the plane of her orbit, as being the result of the accumulation of ice alternately at either pole, depending upon the declension of climate induced by the phenomena of the precession of the equinoxes in either hemisphere alternately, during successive epochs of the period assigned by astronomy to a revolution of the ecliptic, or 25,868 years. According to his theory, the Earth is now progressing towards a secular change of her position upon the plane of her orbit, to be accomplished, with all its contemporaneous phenomena of aqueous and igneous convulsions, as soon as the period of 12,934 years—less the time, some 4,200 years, now elapsed since the deluge of Noah—completes one half of such revolution of the ecliptic. Adhémar's theory, however, though suggestive of a cause, by accumulation of polar ice, of change in the Earth's centre of gravity, is faulty in that he assumes, that the time has not yet arrived for a disproportionate arctic accumulation of ice, and consequent gravitation of the watery envelope of the

globe towards the thus northerly varying centre, tending to depression of sea surface in the southern ocean, and elevation thereof upon shores in the northern hemisphere, which tendencies however are noted by science. The sea surface is ascertained to be rising on the coasts of West Greenland, while depressing on the shores of Australasia, and to have attained, according to Arago, an elevation on the shores of Russian Siberia of several hundred feet above the vast central area of the continent of Asia, and also above the coasts of Europe, from which the waters are receding, thus depressing their surface level.

By the help of eclipses, in which the Earth casts her shadow on the moon, the fact of elongation of the poles by glacial accumulation, as noted in the aspect of the planet Mars, may be ascertained astronomically. Kepler relates that the eclipse of the moon of the 26th September, 1624, which was total and central, surprised him greatly, "for not only," he states, "was the duration of total darkness short, but the remainder of the duration of the eclipse, before and after the total obscurity, was still shorter, as if the Earth were elliptical or lemon-shaped, and had a shorter diameter across the equator, than from pole to pole."

Johannes Von Gumpach, in his astronomical work on the *True Figure of the Earth*, 1862, observes that, "After one hundred and fifty years of unceasing efforts, astronomy has yet to discover whether the terrestrial equator forms an ellipse or a circle; after a century and a half of unsuccessful calculations, analysis is still seen toiling to invent empirical formulas for the purpose of establishing a tolerable accordance between the geodetic measurements of to day, with those of yesterday." He elaborately demonstrates by geometrical computations, and logical hypotheses, upon astronomical and geodetic observations, that the Earth instead of being flattened is elongated at the poles, and attributes to errors of calculations, based on the Newtonian theory, annual losses at sea involving great destruction to life and property.

The first observations recorded of the phenomena of the precession of the equinoxes, are referred to Hipparchus, an early astronomer, who catalogued the stars some 128 years before the Christian era. It is related that Sir Isaac Newton began his investigations respecting the fact of precession with considerable dubiety, stating that, "though not destitute of probability, it might not prove conformable with truth, and involved a mechanical principle taken up without due

consideration." He, however, first submitted a theory of causation, assuming that the primitive molten fluidity of the Earth's volume was an indisputable fact, and hence there had resulted from its velocity of rotation, an equatorial bulge or redundancy of matter, developing a surface subject to unequal attraction by "universal gravitation" of the sun and moon, the result of which is a reeling motion of the Earth's axis,—stated as only with reference to surrounding space, not admitted as within the periphery of the globe itself,—from east to west, and the recession westward of the equinoctial points. In the time of Hipparchus, this recession amounted to 45" annually, but has since varied, and is now stated at about $50\frac{1}{4}$ " annually, equal to one whole degree in seventy years. M. D'Alembert, an ingenious mathematician, attained scientific laurels by his geometrical demonstration of the momenta necessarily evoked by the joint attraction of the sun and moon, resulting in the phenomena of precession. Ever since mathematical demonstration of perturbations stated to be effected by "universal gravitation," has been resorted to, to explain away noted discrepancies of observations, which, duly investigated, might have extended the area of human knowledge of facts in physical astronomy; and displaced a host of questionable hypotheses, in favour of an accumulating code of natural laws, the continuous action of which throughout nature, could be vouched for by incontrovertible data, deduced by careful observation in all departments of physical science. Brewster remarks, "The influence of the imagination as an instrument of research, has we think been much overlooked by those who have ventured to give laws to philosophy. This faculty is of the greatest use in physical inquiries. If we use it as a guide, and confide in its indications, it will infallibly deceive us; but if we employ it as an auxiliary, it will afford us the most invaluable aid." Recent investigations into natural phenomena induce the belief that Newton's solar gravitation theory may be *over-strained* to account for terrestrial movements; and that the maximum obliquity of the angle of intersection of the planes of the equator and ecliptic, may have resulted from an unequal development of polar glacial enlargements, effecting perhaps at first a gradual change, but ultimately a sudden alteration of the earth's centre of gravity, when the bulk of the waters enveloping the globe would gravitate into the hemisphere containing the preponderating glacial accumulation, and, by this unequal oceanic distribution, cause the earth to assume her astronomi-

cally noted position upon the plane of her orbit. The records of scientific exploration and discovery demonstrate that the antarctic regions are less accessible to exploration from accumulated ice, than similar latitudes in arctic regions; while the depth of ocean, tested by soundings (of which one recorded by Captain Ringgold, obtained bottom at 8,000 fathoms, with the elevation of ocean level, displacing the denser strata of the atmosphere), noted barometrically, are greatly in excess of their mean rates, recorded by numerous and careful observations in northern latitudes.

From the position of the sun upon the ecliptic, the northern hemisphere enjoys annually some seven-and-three-quarter days longer solar influence than the southern hemisphere, yielding an excess of the temperature productive of evaporation from the sea surface—twenty-four hours of sun in polar regions being estimated to yield as large a vaporizing effect as twelve hours sun in the tropics, while the precipitation is entirely local—and also tending to great increase of snow storms rather than to intense congelation. Accumulation of snow, and its alternate thaw and congelation, so as to fill up intervening hollows in the mountain peaks, progressing throughout thousands of years, must inevitably affect the earth's centre of gravity, by prolongation of the polar radius.

The vast and increasing height of the snowy pinnacles of the Himalayas—in the mild latitude of 30° north, reaching an altitude of 29,000 feet, or over five miles—induces the belief that the accumulations within the regions of continual precipitation and congelation, must attain a proportional and vastly greater height. If a continuous series of changes in the Earth's centre of gravity are indicated by the ever progressing alterations of sea level over the whole Earth's surface, what conclusions force themselves upon us in the effort to account reasonably for these phenomena? Is the idea of the preponderating influence of Arctic glacial enlargements, continuously augmenting in volume and density, so as gradually to equipoise and ultimately overcome the resistance offered by the antarctic ice, and oceanic enlargement to a more nearly diametric centre of gravitation, not more logical than hypotheses of solar or planetary influences, as acting upon an alleged uniform redundancy of matter, or oceanic enlargement, not yet ascertained to exist, within the tropics? That there are elevated surfaces of watery accumulation in the tropics, is admitted by Arago, who states that so true is it that the waters accumulate in the Gulf of Mexico, that it has

been found by effecting a series of levelling operations across the Isthmus of Panama, that they rise fourteen feet higher in the Gulf than in the Pacific Ocean; whence arises such irregularity under the alleged influences of solar gravitation?

Can astronomy demonstrate that the barometric column indicates by deficiency of atmospheric weight or pressure, that within the tropics there is such a redundancy of watery accumulation, exceptional to the general contour of the earth's surface as, presuming the theory of solar attractions to be irrefutable, may reasonably be held to present an enlarged surface, likely to offer greater attraction to solar influences, than other or more elevated oceanic regions? Maury states that the deficiency of atmospheric pressure at the equator, is represented on the height of the mercurial column by .24 of an inch. This is equivalent to a height of only about 220 feet over the mean level of the sea in the temperate zones. Sir J. C. Ross states the mean barometric pressure at the equator as 29.974, while in latitude 74° south, it was only 28.928, or fully an inch less, or equivalent to an elevation of sea surface, over mean sea level throughout the earth of 800 to 1000 feet. Analysed thus, the alleged equatorial protuberance of water is much less than in high latitudes of the southern hemisphere, and lessening, by a gradual variation, from latitude $22^{\circ}17'$ south. Again, at Melville Island, in latitude $74\frac{3}{4}^{\circ}$ north, it was found to be 29.870, implying an almost equal redundancy of oceanic accumulation to that barometrically ascertained to exist at the equator. Erman, a traveller in Asiatic Siberia, observed a deficiency of pressure on the barometric column, to the extent of an inch and upwards, in the vicinity of Yakutsk, and on the sea of Okotsk; which appears to indicate elevation of sea surface above that at the equator, within the area assumed by the Newtonian theory of the figure of the Earth, to present a depressed or flattened surface.

The deficiency of atmospheric pressure, alike at the equator and in high latitudes, has been referred to an excess of ethereal vapour in the atmosphere, causing its ascent. However applicable to deficiency of pressure at the equator, the reason assigned cannot hold equally good in icy regions. Our barometric readings are at their highest during continuance of calm frosty weather. Moreover, air-borne vapour cannot retain its ethereal condition when exposed to a temperature causing its congelation and descent as snow; while there is

no reason to assume that the higher atmospheric strata in Arctic regions, remain permanently warm enough to retain in suspension accumulated vapours, so as to invariably affect the barometric column as noted by Antarctic explorers, during their "many thousand observations." Arago presumes the existence of atmospheric tides as the result of solar attraction, but these not being indicated barometrically, he suggests that "columns of air, though of different heights, must everywhere be of the same weight, the height compensating for the diminution of weight." The particles of air being rendered lighter by vesicles of vapour adhering to them and expanding them hollowly, certainly ascend, but although thus lightened in the denser strata near the Earth's surface, the increased height of the column must cause an equilibrium of weight as before. But if elevation of the ocean level displaces the densest portion of the atmosphere, deficiency of weight will manifest itself by diminution of pressure.

Observations in nature demonstrate that the waters enveloping the globe, are steadily retreating from certain shores, and gaining upon others; and this on the grand scale of our whole world, without reference to local changes, the possible result of igneous agencies; or of sea waves, in silting up, or denudation. At same time, astronomical observation discloses the fact of the continuous approximation of the plane of the heretofore supposed permanent equatorial intersection of the globe, to the plane of the Earth's orbit of revolution. Are we not therefore justified in the belief that a natural process is at work slowly increasing the density of the matter of the northern hemisphere, and thus its tendency towards a position of coincidence of the planes of the equator and ecliptic; evincing an alteration—progressing uninterruptedly in one direction—in the Earth's centre of gravity. This, however small, and imperceptible in annually recurring quantity, must inevitably effect, as well as mark, a change in the axis of rotation, and consequently, in the position of the polar extremities upon the sphere, giving rise to alteration of the relative positions of the zones of temperature; so that, while one area is being absorbed within the Arctic circle, another within the same latitude, as presently defined, is progressing at the same rate of motion, towards the temperate zone.

It is obvious that the movable matter or oceanic envelope of the globe, must, in obeying the natural law of gravitation, converge towards the centre of gravity of the whole volume

of the Earth. The consequence of a continuous change in this centre, in one direction, must be the progressive increase of depth of the seas, in what,—if we still hold that the poles and equator are unchangeable in position, upon the Earth's surface,—we can only describe as the thus enlarging hemisphere. As the depth of water increases, the coast lines appear to be depressed, and vice versa, with regard to coasts from which the waters are receding. Sir J. C. Ross observes that Baron Von Humboldt suggested the fixing of solid, and well secured marks, for the purpose of showing the mean level of the ocean at a given epoch, stating that, "if similar measures had been taken during Cook and Bouganville's earliest voyages, we should now be in possession of the necessary data for determining whether secular variations in the relative level of land and sea, is a general or merely a local phenomenon, and whether any law is discoverable in the direction of the points which rise or sink simultaneously."

Observations in meteorology demonstrate that a large portion of the vapour abstracted by solar heat from the sea surface, throughout the globe, and lands moistened by tropical rains, or other causes, ascends to the higher regions of the atmosphere, and is conveyed by perpetually flowing air currents, towards the poles. Upon contact with air of Arctic temperature, whether on the lofty peaks of the Himalayas and Andes, in temperate zones, or within the margin of the frigid zones, this air-borne vapour becomes crystallized, and descends as snow, accumulating in vast bulk upon elevated lands, and ice barriers to the altitude of mountains; which continue to increase from century to century. A concomitant result is noted in these regions, especially towards the south western edge of the Arctic circle, namely, that the ocean level is rising upon adjacent coast lines, according to observations in West Greenland, and records of deficiency of atmospheric pressure at sea surface, in the higher latitudes of America and north-eastern Asia. It has been also observed that, while the European seas are receding from the shores, and depressing their surfaces, so that straits in the Baltic, formerly navigable, are being gradually closed to shipping, the southern ocean, adjacent to the coasts of Australasia, have evidently undergone progressive elevation during a prolonged period, without any interval of corresponding depression. Also, that while the climate of Europe is gradually ameliorating (and this, although the surrounding seas are,—from diffusion of cold currents, the result of frequent drifts of ice, dissolving in the

north Atlantic,—so cooled as to unfit them for continuing to be the resort of herrings and other marine productions formerly more abundant,) the climate of the higher latitudes in America is increasing in severity; and that of Yakutsk, in north-eastern Asia, within the temperate zone, is thus described by Erman: “Yakutsk lies about two degrees farther south than Drontheim, in Norway, and about the same distance more south than Beresov, on the Obi. Those places are, therefore, much more sparingly irradiated with the sun’s beams than the country here, and yet they enjoy an incomparably milder climate than that of Yakutsk.” At Yakutsk, Erman “could not expect to find water in a fluid state, till we arrive at the depth of 630 feet, for to that depth the ground is frozen.” (*Travels in Siberia*, p. 366-7.) Again, navigation is found, according to Maskelyne, to be free from proximity of ice barriers, to latitude $84\frac{1}{2}^{\circ}$, north of Spitsbergen, with a northerly prospect of clear sea; while in Behring’s Straits, the ice barrier reaches southerly, so as to approach the limits of the Arctic circle; and no instances are recorded, of ice-bergs drifting therefrom into the north Pacific. Similarly progressive alterations of climate are exhibited in regard to the mainland of Cape Horn, in $53\frac{1}{2}^{\circ}$ south latitude, enjoying so mild a temperature, that humming birds are its summer visitants,* contrasting with areas approximating to Australia, which continent appears, as well superficially, as by result of geological observations, to be deteriorating from a tropical to a coolly temperate climate.

Upon these grounds, and regarding astronomical evidences as confirmatory thereto, we submit that the north frigid zone, the portion of the hemisphere receiving, from position, the least solar heat, and of which the pole must be the true centre, is verging south-westward so as to approach the north temperate region; with presumptive evidence in support of similar progressive changes in the southern hemisphere. We thus submit evidence of an apparent deviation of the Earth’s polar axis, marked by aberration of the poles from the position on its surface, assigned permanently to them by

* “Parrots and humming birds are numerous in the southern and western part of the Straits, the latter sucking the fuschia and other flowers; in the winter month of May—range to Valparaiso. No such bird inhabits to $53\frac{1}{2}^{\circ}$ north.” “Hills of Cape Horn are not covered with snow, even in winter.” “The natives of Terra del Fuego are perfectly nude; vegetation also proclaims the winters to be mild.”—See “*Voyage of Chanticleer to Southern Atlantic Ocean.*” By W. H. Webster. London: 1834.

geographers. The continuous accumulation of dense and ponderous matter, such as congealed snow and ice, in vast mountain masses, many miles in altitude, in such position on the Earth's surface as increase the polar radii disproportionately, must vary the centre of gravity of the Earth's volume, and induce gravitation of watery particles to such varying centre. The inevitable result, in absence of adequate compensatory influences, must be to cause, and continuously maintain, a deviation of the polar axis, and a consequent change in the position of the Earth upon the plane of her orbit. We cannot assume the correctness of the theory of gravitation at one time, and discard it at another, because its developed action results in production of forces, and their effects, at variance with our prepossessions, or the deductions of our early and greatest philosophers.

The accuracy of scientific theories as to the motions *inter se* of the planets of our system, and respecting the celestial orbs generally, appears vouched for by the precision with which occultations, eclipses, and other phenomena are computed. Yet, astronomic theories may be altogether at fault, as to the accurate definition of the figure of our Earth, its bisection equally by our equatorial line, and the consequent position upon its superficies, of the parallels of latitude, as well as regards terrestrial alterations of longitudes, resulting from a westerly movement of the Arctic pole of the axis of rotation. Sir. J. Herschel in *Outlines of Astronomy*, remarks that "no instruments ever yet invented by man, are delicate enough to indicate, by an increase or diminution of the angle subtended, that one point of the Earth is nearer to, or farther from the stars than another;" calculations accurate as to the stars are therefore not necessarily presumptive of terrestrial immobility of the points upon the globe, of the poles of the axis of rotation. Hence we join issue in the stated belief of certain geologists, that the geological structure of the strata forming the Earth's exterior crust, can only be accounted for, on the hypothesis of such a change of the Earth's axis of rotation. Such change, if continuous, evidently involves alteration in the configuration of the land and seas upon the Earth's surface, progressing gradually throughout ages, in the direction indicated by, and amount proportioned to, the annual change in the position in process of being assumed by the Earth upon the plane of her orbit. As evidenced in past geological epochs, this gradual change is liable to be suddenly accelerated, when a disastrous revolution would ensue,

developing igneous, as well as aqueous agencies, the alternating operation of which, during such convulsions, have been abundantly noted by all geologists. Oscillation of the globe, to regain its equilibrium, would be succeeded by renewed rotation upon an axis passing through its centre of gravity; but the poles of such axis might then occupy an opposite, or totally different position upon the Earth's surface, and thus transpose the relative positions of the arctic and tropical regions now existing.

Sir C. Lyell remarks, "It can be shown that the Earth's surface has been remodelled again and again; mountain chains have been raised or sunk, valleys formed, filled up, and then re-excavated; sea and land have changed places, yet throughout all these revolutions, and the consequent alterations of local and general climate, animal and vegetable life has been sustained." "The changes of ocean level required to swamp continents, are not so great as might be supposed. A rise of 500 feet would sink the sources of the Volga, and drown the most of Europe, 800 feet would sink Basle, 1400 feet the Clyde, 1200 feet the Lake of Constance, 2850 feet the sources of the Danube, 4500 feet would sink the Elbe, and boulders are found as high on European watersheds—in Scotland, Scandinavia, Wales, Ireland, and central Europe! In America, 680 feet would sink Lake Superior, and the bottom of Lake Ontario is below sea level now. If terraces be sea marks, there are terraces on Snowdon, and the Alps at 3000 feet; drift, shells, boulders, and rounded stones, record that a frozen sea, 2000 feet deep, has passed over the sites of London, Edinburgh, and Dublin. Mr. Geikie, in his work on *The Glacial Drift of Scotland*, proves that the land of the British Isles has been submerged to a height which would only leave a few hill tops above water.

The Rev. J. Tenison Woods, F.G.S., states that a recent scrutiny of over 2000 fossils proves that, during the period when the British Isles and Northern Europe were exposed to glacial action, and to partial submergence beneath an icy sea, the southern colonies of Australia abounded in the vegetation and organisms peculiar to tropical climates.

"That the ice epoch, like other great events in Nature, came on gradually and slowly is," it is stated, "abundantly evidenced by the temperate, or even coldly temperate aspects of the flora and fauna of the later, as compared with those of the middle, and earlier tertiaries. Thus, over the tertiary areas, the declension of climate had been going on for ages,

before the advent of the glacial period." The discovery, however, of elephant and mammoth remains, in a comparatively perfect state, on the shores of the Icy Sea, demonstrates that the change of climate occurring at their deposit must have been instantaneous, otherwise and unless the carcasses were frozen at moment of deposit, decomposition must have taken place. "The tusks of at least 100 mammoths, or about 40,000 pounds of ivory, are bartered for every year in New Siberia. Notwithstanding the large amount carried away, the supply does not seem to diminish. The remains are scattered along the valleys and near the mouths of great rivers; and, in a number of instances, the mammoth entire has been discovered, with its skin protected by a double covering of hair and wool, and its flesh in such preservation as to afford food for dogs and wild beasts. Whatever the cause of the Siberian mammoth's death, it is certain they were suddenly enveloped in ice, which has not been previously disturbed since they were first entombed." "There is not," says Pallas, "in all Asiatic Russia, a stream or river, in the banks of which are not to be found the remains of elephants and other animals now strangers to that climate."

Hypotheses have been submitted accounting for the above phenomena, by the effect of sudden upheaval, by igneous agencies of the Himalayan range, causing devastating destruction, by force of torrents, resulting from the vast precipitation consequent upon elevation of the summits, far within the limits of perpetual snow. Such hypotheses are, however, quite inadequate to account for the cataclysmal convulsions revealed by geology; which, with due regard to all the phenomena presented, admit of but one mode of explanation, namely, that they have resulted from a sudden change in the axis of rotation of the Earth caused by change of her centre of gravity, and necessary oscillation—involving oceanic disruption—until brought to quiescence by gravitation of all movable matter on the surface to a position vertical to the new centre of gravity. The astronomical position of the Earth, "tilted," as Sir J. Herschel terms it, upon the plane of her orbit, is the evident result, as observations in Nature demonstrate, of the accumulation of the bulk of the waters of the globe in the Southern Hemisphere. What do presently progressing changes prognosticate as to the temporal destiny of a large section of the human race, if, by earthquake disruption, an entrance of the ocean should take place into the vast central cavity

of Asia, now several hundred feet beneath the ocean level; or, if igneous agencies break up and disperse the Polar ice? A sudden loss of equilibrium must ensue, inaugurating a devastating cataclysmal convulsion. Some such contingency is evidently alluded to in Psalm lxxiv. 13—15, as possibly to alter the configuration and position of continents and oceans of the globe, and drift to the wilderness the leviathans of the deep. In view of its probability, though, perhaps, not in our day, nor even in this era of our globe's history, "Men's hearts" may well "fail them for fear, and for looking after those things which are coming on the "Earth." The day of which "shall come as a thief in the night."

Professor Jameson remarks that "the coal formation of East Greenland is the same as that of the great coal mines of Scotland and England. This formation always contains impressions and casts of plants which have a tropical aspect, a circumstance of high interest when combined with the arctic situation of the coal. Remains of plants with tropical characters evidently in their native place of growth under the 75th degree of north latitude, is a fact which naturally leads to very interesting discussions in regard to the ancient forms of the land, and the former state of the climate."

Professor Houghton, in his "Geological Account of the Arctic Archipelago," in appendix to Captain McClintock's work on the Fate of Franklin, &c., observes that "The discovery of fossils, *in situ*, of the ammonite, evidently belonging to the liassic period, in 76° north latitude, is calculated to throw doubts upon the theories of climate, which would account for all past changes of temperature by changes in the relative position of land and water on the Earth's surface. Besides the ammonite belonging to a warmly temperate or tropical sea, fossils of vertebrata and saurian reptiles have also been found in latitude 76°. If the change of temperature be supposed to be caused by a change of the relative position of land and water, the temperature of Dublin or of some place on the parallel of latitude, must be supposed to be raised to 99° Fahr., while the temperature of the thermal equator will exceed 124°. The theory of central heat also appears to me open to the same objection, as a mode of explaining this remarkable geological fact, for it will simply add a constant to our present climates, leaving the difference to remain as at present to be accounted for by latitude and the distribution of land and water. The

astronomical theory of Herschel also, which would account for former changes of climate, by changes in the radiating power of the sun would only increase the temperature at each latitude, leaving the difference as at present. The only speculation with which I am acquainted, which is capable of solving this *opprobrium geologicorum*, is the hypothesis of a change in the axis of rotation of the earth, the admission of which, as a geological possibility, is mathematically demonstrable, and which has recently had some singular evidence in its favour advanced by geologists. In 1851, I brought forward at the Geological Society of Dublin, a case of angular fragments of granite, occurring in the carboniferous limestone of the County of Dublin; and I explained the phenomena by the supposition of the transporting power of ice. In 1855, Professor Ramsay laid before the Geological Society of London, a full and detailed theory of glaciers and ice, as agents concerned in the formation of a remarkable breccia of Permian age, occurring in the central counties of England; and, still more recently, the same agent has been employed by the geological surveyors of India, to account for the transport of materials, at geological periods long antecedent to those in which ice transport is commonly supposed to have commenced. The motion of the earth's axis would reconcile all the facts known, and it must be regarded as a geological desideratum to determine its amount and direction, and to assign the cause of such a movement. The solution of this problem I regard as quite possible. It is well worthy of remark, that the arguments from the occurrence of coal plants and ammonites strengthen each other; the coal plants rendering the question of light, and the ammonites that of heat, insuperable objections to the admission of any received geological hypothesis, to account for the finding of such remains *in situ* in latitudes so high as those of Melville Island, Prince Patrick's Island, and Exmouth Island."

Professor Ram considers that "nothing less than aberration of the axis of the Earth can adequately account for the varied phenomena forming the problems of geology." The same view has been set forth by other geologists, including Sir Henry James and Mr. Evans, secretary to the Geological Society; but astronomical assumptions have heretofore promptly quelled analysis of the question.

La Place, while maintaining the permanent immobility of the Earth's axis of rotation, hazarded a conjecture that

proximity of a comet might have formerly sufficed to shift it, causing Noah's deluge. Professor Brande observes, "In whatever manner the Earth may have taken its existing form, there are abundant proofs that its surface has been the theatre of many great revolutions. The masses of sand and gravel, and beds of limestone, composed of shells and corals, which are found in the interior of continents, and even to the summits of the highest mountains, plainly show that the present land was once immersed deep under the waters of the ocean. The remains of animals and plants belonging to tropical countries found in the highest latitudes indicate an entirely different disposition of climates from that which now exists." Such convulsions having occurred periodically throughout the vast antiquity ascribed to our Earth by geology, evidence former changes in her centre of gravity, and consequent axis of rotation; and, therefore, demonstrate an uncertainty as to the position upon the Earth's crust now of the original poles, supposed by the Newtonian theory to be flattened by its velocity of rotation, in its primitive condition of an incandescent and molten mass of matter. The present age is one of scientific investigation into principles of causation, and mere recapitulation of the unsupported, if not exploded, hypotheses of our early philosophy, based upon very imperfect knowledge, do not meet the importance of ascertaining the truth, involving the future tendencies of the agencies brought to light.

The observant geologist and student of nature have in Victoria many opportunities for noting the comparatively small deposit, apparently marking the last geological convulsion (universally referred to Noah's Deluge) upon certain localities, disclosing to shallow excavations the proximity of primitive formations, however deep, sedimentary strata of the most recent type may be proved elsewhere. Such observations furnish evidence that the amount of deposition, or even denuding action, of cataclysmal convulsions, is not uniform, or sufficient in all cases to give force to the very common objection against ascribing to ancient edifices, such as those Sir C. Lyell assumes "approach nearest to immortality,—cones, the pyramid, the tumulus, and the cairn," an antediluvian origin; that the very existence of such ancient relics must have been obliterated from view by the necessarily great depth of sedimentary deposit.

Anomalies are occasionally presented to our imperfect knowledge in the aspect and constituent earthy matter and

organisms of rock structure, which are as yet unaccounted for by our philosophy, and thus, perhaps, regarded as subverting the Mosaic version of the period of the human era in our Earth's past history, instead of being really confirmatory of its truth, and furnishing elucidatory evidence in favour of a literal descriptive meaning being assignable to the sacred predictions as to the now looming future history of our wondrous sphere.

Aqueous action, resulting from denudation by the mighty agency of oceanic disruption, is adequate to account for comminution of sedimentary strata, and ultimate re-deposit thereof. And chemical concretion, or igneous vitrification of matter so commingled, may account satisfactorily for noted facts respecting the jumbling together of relics of art of ponderous and durable materials, such as pottery, flint implements, &c., of the human antediluvian era, in conjunction with *fossil* organisms of the earlier epochs, in aqueous deposits, from the vicinity of which the lighter carcasses of the drowned beings, and their cotemporary animals and vegetable organisms, or fabrics, must have been swept off and accumulated in presently unexplored localities, perhaps ever since concealed in icy regions.

Our investigations justify the assumption that there are moot points as yet undecided between the hypotheses accounting for terrestrial phenomena as viewed by scientific reasoners of the present day, and the tenor of received theories of our early philosophers, based upon data from less perfect sources of information than are now available. Innovations may be humiliating, but truth must be sought for, and, as found, retained at all hazards, even if the whole structure accredited as the science of physical astronomy require remodelling on the basis of ascertainable physical *facts*, and not mere hypotheses backed up by geometric demonstrations of the possibility of their accuracy, and calculations of the momenta necessary, defined with mathematical precision. Although scientific knowledge is wonderfully increased since the era of publication of Sir Isaac Newton's "*Principia*," yet, still, as remarked by him, the philosopher but wanders with child-like uncertain steps by the margin of the ocean of Truth, securing here and there a pebble-fact of more than ordinary moment, while the boundless expanse of knowledge is beyond, ever tempting him *onward*.

Sir Charles Lyell remarks, "A false theory may render us

blind to facts which are opposed to our prepossessions, or may conceal from us their true import when we behold them." There may be consolation in the reflection that the blindness thus occasionally affecting even earnest scientific investigators has not happened by chance, having been predicted. (See Isaiah xxix. 14.) The up-hill task of demolishing the unsound fabric of theory, based upon long-cherished but fallacious "prepossessions," may be arduous unless light be granted, making it clear that according to Galileo, "Scripture and Nature proceed from the same Source, and are, therefore, incapable of speaking a different language." He pointed out the absurdity of supposing that professors of astronomy would refuse to believe those deductions of reason which appealed to their judgment with all the power of demonstration. Yet Galileo's noblest discoveries were the derision of his contemporaries! Brewster remarks that "men are not necessarily obstinate because they cleave to deeply-rooted errors; nor are they absolutely dull when they are long in understanding, and slow in embracing newly-discovered truths." Therefore we must bear in mind that in questions of science, the *authority* of a thousand is not worth the humble *reasoning* of a single individual. "The simplest ideas," La Place remarks, "are usually those which are the last to force themselves upon us."

ART. XVII.—*On a Remarkable Symmetrically Deformed Skeleton.* By GEORGE B. HALFORD, M.D., Professor of Anatomy, Physiology, and Pathology, in the University of Melbourne.

[Read 24th September, 1868.]

This remarkably deformed skeleton is the property of the Melbourne University. It was purchased for me at Paris in 1862, by Messrs. Raginal and Co., and is stated to have been prepared by the late Dr. Sue. The being, whose skeleton is here represented, with pipe in hand, is said to have played the instrument on the steps of one of the churches in Paris, and to have attained the age of twenty-eight years. Further than this, I have not been able to obtain any information.

The height of the skeleton as it now rests is two feet six